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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/698,878	10/31/2003	Cyprian E. Uzoh	NT-308-US	1999
20995	7590	01/19/2007		
KNOBBE MARTENS OLSON & BEAR LLP			EXAMINER	
2040 MAIN STREET			VAN, LUAN V	
FOURTEENTH FLOOR				
IRVINE, CA 92614			ART UNIT	PAPER NUMBER
			1753	
SHORTENED STATUTORY PERIOD OF RESPONSE		NOTIFICATION DATE	DELIVERY MODE	
3 MONTHS		01/19/2007	ELECTRONIC	

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

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Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary

Application No.

10/698,878

Applicant(s)

UZOH ET AL.

Examiner

Luan V. Van

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 December 2006.
2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 1-16 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/05)
Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____

DETAILED ACTION
Response to Amendment

Applicant's amendment of December 4, 2006 does not render the application allowable.

The amendment is objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure. 35 U.S.C. 132(a) states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: Claims 1-16 are amended to recite the limitations of "determining a transition current density at a single level" and "after determining the transition current density". However, there is no clear evidence in the applicant's disclosure to support the recitation of a single level or performing an electrodeposition process after determining the transition current density. The disclosure, therefore, does not provide a clear indication to support the limitations. Applicant is required to cancel the new matter in the reply to this Office Action.

Status of Objections and Rejections

All rejections from the previous office action are withdrawn in view of Applicant's amendment.

New grounds of rejection under 35 U.S.C. 103(a) are necessitated by the amendments.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-16 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claims 1-16 are amended to recite the limitations of "determining a transition current density at a single level" and "after determining the transition current density". However, there is no clear evidence in the applicant's disclosure to support the recitation of a single level or performing an electrodeposition process after determining the transition current density. The disclosure, therefore, does not provide a clear indication to support the limitations.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148

USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dubin et al. in view of Lu et al.

Regarding claims 1-2 and 9-10, Dubin et al. teach an electrodeposition process on a plurality of workpieces, each electrodeposition process comprising the steps of: determining the transition current density 706; applying an initial process current density (figure 7, feature 702) as the workpiece surface enters the process solution, wherein the initial process current density is lower than the transition current density; applying a first process current density (figure 7, feature 714) to fill the cavity (for holes having a size of 0.3-0.6 μm), wherein the first process current density is substantially the same as the transition current density; and applying a second process current density (figure 7, feature 722), wherein the second process current density is higher than the transition current density.

Although Dubin et al. is silent with respect to the phrasing of forming a "substantially flat profile over the opening of the cavity," Dubin et al. teach that their invention reduces "die non-uniformity, measured as a reduction of hump step height

over small features" (column 6 lines 46-49). Further, "The uneven surface morphology presented by these humps leads to overpolishing in subsequent chemical mechanical polishing operation" (column 3 lines 45-47). Dubin et al. further disclose "the supefill and reverse plating steps can be repeated a number of times prior to the bulk fill operation in order to provide the desired surface morphology for chemical mechanical polishing (CMP)" (column 5 lines 35-38); and that "various combinations of forward and reverse current densities and durations may be used within the scope of the..invention" (column 6 lines 59-62). Therefore, it would have been obvious to one having ordinary skill in the art to have expected that the electroplating method of Dubin et al. that reduces die non-uniformity would yield a substantially flat profile over the surface features.

With respect to the amended limitation of determining a transition current density at a single level, the transition current density 706 of Dubin et al. is a determined or predetermined value, because it is selected within a specified range as disclosed by Dubin et al. (column 6 lines 30-35, Fig. 7) and not selected by random chance. Secondly, the transition current density 706 of Dubin et al. at a single level as shown in Fig. 7 is capable of filling the cavity with the conductive material and forming a substantially flat profile over the opening of the cavity, because Dubin et al. teach that their invention reduces "die non-uniformity, measured as a reduction of hump step height over small features" (column 6 lines 46-49).

Nevertheless, Lu et al. teach using a single current density within the range of 0.5-5 ASD, or 5-50 mA/cm², which is within the range of Dubin et al., to fill cavities so

as to form a surface-flat and void-free plated copper layer (paragraph 9 and 29, and Fig. 4).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have expected that the transition current density of Dubin et al. would form a substantially flat profile over an opening of the cavity, because Lu et al. teach that a current density within the range of Dubin et al. would form a surface-flat and void-free plated copper layer (paragraph 9 and 29, and Fig. 4 of Lu et al.).

Regarding claim 8, Dubin et al. teach repeating the forward current steps multiple times (column 5 lines 39-41).

Regarding claims 3-7 and 11-16, Dubin et al. teach "the first, second, third, fourth, and fifth forward currents are each different from the other and monotonically increasing in this illustrative embodiment. The magnitudes of the current densities of the first, second, third, and fourth currents is between 10 and 30 mA/cm² with a duration of between 2 and 60 seconds each" (column 6 lines 33-35), and this "range of current magnitudes and pulse widths provides a reduction in void formation and improved surface morphology" (column 6 lines 10-15).

The difference between the reference to Dubin et al. and the instant claims is that the reference does not explicitly teach the different sequences of various current density pulses having different durations.

However, regarding claims 3-7, Dubin et al. teach that "the magnitudes of the current densities of the first, second, third, and fourth currents is between 10 and 30 mA/cm² with a duration of between 2 and 60 seconds each" (column 6 lines 33-35); and

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the "forward current steps may include two or more sub-steps" (column 5 lines 39-45).

Furthermore, "various combinations of forward and reverse current densities and durations may be used within the scope of the..invention" (column 6 lines 59-62).

Regarding claims 11-16, the first and second time period can be selected within the range between 2 and 60 seconds as taught by Dubin et al. such that the first time period is equal to, greater than, or less than the second time period.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Dubin et al. by optimizing various combinations of current densities and durations to produce a substantially flat surface profile, because it would reduce defects caused by overpolishing of the plated features (column 3 lines 45-49).

Response to Arguments

Applicants' arguments have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luan V. Van whose telephone number is 571-272-8521. The examiner can normally be reached on M-F 9:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

LWV
January 10, 2007



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